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(54) TITLE OF INVENTION: Oil-in Water and Fat Emulsion for Use in Cakes and a Method for its Use in Cake Making

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DETAILED EXPLANATION

1. TITLE OF INVENTION:

Oil-in-Water and Fat Emulsion for Use in Cakes and a Method for its Use in Cake Making

2. CLAIMS

Claim 1

An oil-in-water and fat emulsion for use in cakes containing 1-10 wt% cyclodextrin, and 0.05-5 wt% (anhydrate conversion) of table salt, citrate, tartrate or sulfate.

Claim 2

An oil-in-water and fat emulsion for use in cakes containing 1-10 wt% cyclodextrin and 0.05-5 wt% polyglycerol fatty acid esters.

Claim 3

An oil-in-water and fat emulsion for use in cakes containing 1-10 wt% cyclodextrin, 0.05-5 wt% (anhydrate conversion) of table salt, citrate, tartrate or sulfate, and 0.05-5 wt% polyglycerol fatty acid esters.

Claim 4

The oil-in-water and fat emulsion for use in cakes of any of Claims 1 through 3, wherein the citrate is selected from a group consisting of lithium citrate, potassium citrate, sodium citrate, magnesium citrate, calcium citrate and ferric citrate; the tartrate is selected from a group consisting of sodium tartrate, potassium tartrate, potassium sodium tartrate and

calcium tartrate; and the sulfate is selected from a group consisting of aluminum sulfate, potassium sulfate, calcium sulfate, sodium sulfate and magnesium sulfate.

Claim 5

The oil-in-water and fat emulsion for use in cakes of Claim 2 or Claim 3, wherein the polyglycerol fatty acid esters are esters composed of polyglycerol with 1-15 glycerol units and poly hydroxy carboxylic acid.

Claim 6

The oil-in-water and fat emulsion for use in cakes of Claim 2 or Claim 3, wherein the polyglycerol fatty acid esters are esters with an esterification of 3-10 composed of saturated or unsaturated fatty acids having 16-24 carbons and polyglycerol with 4-10 glycerol units.

Claim 7

A method for cake making, the primary characteristic of which is the addition of an oil-in-water and fat emulsion for use in cakes containing 1-10 wt% cyclodextrin and 0.05-5 wt% (anhydrate conversion) of table salt, citrate, tartrate or sulfate.

Claim 8

A method for cake making, the primary characteristic of which is the addition of an oil-in-water and fat emulsion for use in cakes containing 1-10 wt% cyclodextrin and 0.05-5 wt% polyglycerol fatty acid esters.

Claim 9

A method for cake making, the primary characteristic of which is the addition of an oil-in-water and fat emulsion for use in cakes containing 1-10 wt% cyclodextrin, 0.05-5 wt% (anhydrate conversion) of table salt, citrate, tartrate or sulfate, and 0.05-5 wt% polyglycerol fatty acid esters.

Claim 10

The method for cake making according to any of Claims 7 through 9, wherein the citrate is selected from a group consisting of lithium citrate, potassium citrate, sodium citrate, magnesium citrate, calcium citrate and ferric citrate; the tartrate is selected from a group consisting of sodium tartrate, potassium tartrate, potassium sodium tartrate and calcium tartrate; and the sulfate is selected from a group consisting of aluminum sulfate, potassium sulfate, calcium sulfate, sodium sulfate and magnesium sulfate.

Claim 11

The method for cake making according to Claim 8 or Claim 9, wherein the polyglycerol fatty acid esters are esters composed of polyglycerol with 1-15 glycerol units and poly hydroxy carboxylic acid.

Claim 12

The method for cake making according to Claim 8 or Claim 9, wherein the polyglycerol fatty acid esters are esters with an esterification of 3-10 composed of saturated or unsaturated fatty acids having 16-24 carbons and polyglycerol with 4-10 glycerol units.

3. Detailed Description of the Invention

[Field of the Invention]

The present invention relates to oil-in-water and fat emulsions for use in cakes and a method for cake making using such. More specifically, it relates to oil-in-water and fat emulsions for use in cakes and a method for cake making using such, such that the original flavor of cakes such as a sponge cake is utilized and moreover the making of cakes having a moist texture is made considerably simpler.

[Prior Art and Related Problems]

Among the types of sponge cake there are sponge varieties such as sponge sheet, sponge roll and round decorated, and biscuit sponge cake baked confections such as busse, Othello, and finger cakes. In general, these are made by mixing together sugar, eggs, (water), and flour, whipping and then baking. Recently, to further improve the flavor and texture and yield a moist texture, consideration has been given to adding fats and oils.

In making sponge cakes, the timing of the mixing of the above-described ingredients is one of the major factors in determining how good or bad the final product will be. That is to say, conventionally, it has been said that the flour and fats or oils hinder and destroy (defoam) the aeration of the egg and sugar mixed batter. Thus, the method of mixing in the flour and fats and oils has been previously studied.

As for the methods of adding fats and oils that have been developed up to this point, there is a method in which a cake-use foaming agent is mixed into the sugar and egg prior to whipping, and a method in which this is added with much care after whipping (the falling batter method). As for the cake-use foaming agent referred to here, there are products with sugar ester and other emulsifiers combined with monoglyceride, for instance Ryoto Ester SP (made by Mitsubishi-Kagaku Foods Corp.) and Top Unik (made by Okuno

Chemical Industries Co. Ltd.). A representative composition would be 10% sucrose fatty acid ester, 8% glycerin fatty acid ester, 5% sorbitan fatty acid ester, 5% propylene glycol and 25% D-sorbit. In addition, it appears that foaming fats and oils in which the fat and oil is kept in an oil-in-water emulsion by an emulsifier are used, with a cake-use foaming agent as the basic structure, such as Hi-Low (made by Kao Soap Co.) and Whipping Oil (made by Mitsubishi-Kagaku Foods). These cake-use foaming agents or foaming fats and oils have the job of stabilizing the bubble structure after the sponge cake batter has been aerated, and appear to enable the addition of fats and oils. On the other hand, as noted above, cake-use foaming agents and foaming fats and oils have emulsifiers as a leading component, and according to the amount (from the "Ryoto Ester SP Manual" created by Mitsubishi-Kasei Foods Corp.) needed to facilitate the addition of fats and oils (that is to say, the amount that eliminates defoaming of fats and oils), when 11.9 parts by weight batter is added to 100 parts by weight flour, 7.1 parts by weight cake-use foaming agent is added, or when 24.2 parts by weight fats and oils are added, 8.3 parts by weight cake-use foaming agent is added. In addition, according to the Hilofty Manual (created by Kao Soap), if 15 parts by weight foaming fats and oils are added to 100 parts by weight wheat flour, unpleasantness will result, such as the sponge cakes having an emulsifier odor, the delicious flavor of the eggs disappearing or an unpleasant sweetness remaining, so that the original flavor of the sponge cakes will be lost. However, when not using cake-use foaming agents or foaming fats and oils, or reducing the amount used, this has the disadvantage of having poor handling requiring someone skilled in the art, such as manipulating the degree of stirring or determining the timing of adding fats and oils while observing the state of the batter because of the defoaming nature of fats and oils.

As a method of eliminating the defoaming nature of fats and oils, a method has been disclosed (Japanese Public Patent Disclosure 61-67433) in which a mixture is used whose primary components are fats and oils, water and cyclodextrin.

By adding the resulting mixture as the source of fats and oils, it is possible to add fats and oils to the cake without losing the cake's flavor and to create a cake that melts in your mouth even better, which is the desired object of the invention.

[Problem Resolution Means]

As a result of studying a variety of methods for making various sponge cakes using the resulting mixtures whose primary components are fats and oils, water and cyclodextrin, the inventors came upon the present invention by discovering that it is possible to improve the melt-in-your-mouth aspect of sponge cake without losing the sponge cake flavor by using, at the same time as cyclodextrin, salts such as table salt, citrates, tartrates and sulfates and/or polyglycerol fatty acid esters.

In other words, one invention provides an oil-in-water and fat emulsion for use in cakes containing 1-10 wt% cyclodextrin, and 0.05-5 wt% (anhydrate conversion) of one or two or more of table salt, citrates, tartrates or sulfates.

A second invention provides an oil-in-water and fat emulsion for use in cakes containing 1-10 wt% cyclodextrin and 0.05-5 wt% polyglycerol fatty acid esters.

A third invention provides an oil-in-water and fat emulsion for use in cakes containing 1-10 wt% cyclodextrin, 0.05-5 wt% (anhydrate conversion) of table salt, citrates, tartrates or sulfates, and 0.05-5 wt% polyglycerol fatty acid esters.

A fourth invention provides a method for cake making, the primary characteristic of which is the addition of an oil-in-water and fat emulsion for use in cakes containing 1-10 wt% cyclodextrin and 0.05-5 wt% (anhydrate conversion) of table salt, citrates, tartrates or sulfates.

A fifth invention provides a method of making cakes, the primary characteristic of which is the addition of an oil-in-water and fat emulsion for use in cakes containing 1-10 wt% cyclodextrin and 0.05-5 wt% polyglycerol fatty acid esters.

A sixth invention provides a method of making cakes, the primary characteristic of which is the addition of an oil-in-water and fat emulsion for use in cakes containing 1-10 wt% cyclodextrin, 0.05-5 wt% (anhydrate conversion) of table salt, citrates, tartrates or sulfates, and 0.05-5 wt% polyglycerol fatty acid esters.

As the citrate used in the present invention, lithium citrate, potassium citrate, sodium citrate, magnesium citrate, calcium citrate and ferric citrate can be cited, and these may be used independently or in a mixture of two or more, but potassium salt and sodium salt are particularly desirable.

As the tartrate used in the present invention, sodium tartrate, potassium tartrate, potassium sodium tartrate and calcium tartrate can be cited, and these may be used independently or in a mixture of two or more, but potassium salt and sodium salt are particularly desirable.

As the sulfate used in the present invention, aluminum sulfate, potassium sulfate, calcium sulfate, sodium sulfate and magnesium sulfate can be cited, and these may be used independently or in a mixture of two or more, but potassium salt and sodium salt are particularly desirable.

As polyglycerol fatty acid esters, those with low HLB values are good from the standpoint of solubility, and accordingly, it is best to have a small number of glycerin units, a large number of carbons and a large degree of esterification. For example, an ester made from a fatty acid having 10-24 carbons and 1-15 glycerin units would be optimal. In particular, there are esters made from polyglycerol having 2-10 glycerin units and 10-24, and most preferably 14-20, carbons in a straight chain or branched chain and saturated or unsaturated, and poly hydroxy carboxylic acid with 2-10, and most preferably 3-6, hydroxyl carboxylic acid units. For example, there are fatty acid esters that can be selected from a group made up of polyglycerol, ricinoleic acid and condensed ricinolate in which the ricinoleic acid concentration is 2-10, and most preferably 3-6.

Among the products on the market are SY Glyster CR-310 and CR-500 made by Sakamoto Yakuhin Kogyo Co. Ltd. Furthermore, it is also possible to use esters with an esterification of 3-10 made from polyglycerol having 4-10 glycerin units, and saturated or unsaturated fatty acids with 16-24 carbons, for example tetraglycerol stearate pentaester, hexaglycerol stearate pentaester, decaglycerol stearate decaester, tetraglycerol oleate pentaester, decaglycerol oleate decaester, and the like.

As the fats and oils used in the present invention, vegetable oils such as corn oil, cottonseed oil, vegetable oil, soybean oil, sunflower oil, olive oil, safflower oil, palm oil and the like, animal fats and oils such as lard, fish oil, beef tallow, sperm oil and the like, and furthermore hydrogenated oils, fractionated oils and ester exchange oils of these can be cited, and these may be used independently or in combinations of two or more.

Cyclodextrin is a cyclic oligosaccharide also known as Schardinger dextrin or cycloamylose, and is completely different from emulsifiers. The cyclodextrin used in the present invention may be of the type synthesized by having a type of amylase that produces Bacillus act on starch, or of the type synthesized by having a type of amylase that produces Micrococcus act on starch, or of the type synthesized through other methods, but because cyclodextrin that is not sufficiently refined has the disagreeable flavor of starch, it is preferable to use a product that has been adequately refined. As the benchmark for refining, if impurities other than cyclodextrin synthesized through the glucoamylase method are 0.3 wt% or less, they will have essentially no flavor or odor and will not have an effect on the flavor of the sponge cake. In this case, impurities that can be cited include starch, non-cyclic dextrin and sugars. The cyclodextrin used in the present invention is insoluble in oils and fats, and hence is used after first being dissolved and dispersed in water. It is used in a range of 15-70 wt% water. The upper and lower limits of oil and fat content in the oil-in-water and fat emulsion for cakes (hereinafter called the emulsion) may be determined by taking into consideration the stability of the oil and fat composite, and are preferably 30-80 wt%. In addition, cyclodextrin is used in the 1-10 wt% range. If the amount is less than is stipulated by this range, the oil and fat composite can easily become unstable, while conversely, if the amount is more than that

stipulated, the viscosity of the oil and fat composite rises, making uniform dispersion in the batter difficult.

The oil-in-water and fat emulsion may be mixed with sugar and the like, then aerated and finally mixed with wheat flour, or may be mixed into the stock in which the sugars have been mixed and aerated, together with wheat flour.

The amount of the oil-in-water and fat emulsion added in the present invention is not particularly restricted, but it is preferable to add enough that the amount of oil and fat becomes 5-100 parts by weight for 100 parts by weight of wheat flour. The wheat flour used in cake making is not particularly restricted, but soft flour is generally used in making sponge cakes. In addition, the sugar is not particularly limited, but very-refined sugar, sorbitol or the like is used.

Components other than cyclodextrin, water and the oil and fat of the emulsion are not particularly restricted in the present invention, but as an example, the ingredients may include oil-soluble essences, water-soluble essences, dairy products, milk, fermented foods, prepared oils and fats, eggs and processed egg products, horticultural foods, seasonings, vegetables, nuts, seaweed and processed seaweed products, meat and processed meat products, and the like.

The total amount of anhydrate conversion of table salt, citrates, tartrates and sulfates added in the present invention is 0.05-5 wt%, and more preferably 0.1-3 wt%. If the amount added is less than this range, the effect of improving the melt-in-your-mouth aspect of the cake is not sufficiently exhibited, whereas if this range is exceeded, the flavor of the cake may be lost.

The amount of polyglycerol fatty acid ester added in the present invention is 0.05-5 wt%, and when the amount added is less than this range, the effect of improving the melt-in-your-mouth aspect of the cake is not sufficiently exhibited, whereas if this range is exceeded, the flavor of the cake may be lost.

[Embodiments]

Preferred embodiments of the present invention and comparative examples are explained in further detail hereafter, but these are intended to be illustrative and not limiting.

Embodiment 1

Corn oil	650g
Water	314g
β-cyclodextrin	30g
Sodium citrate	3g
Table salt	3g

In the above combination, the β-cyclodextrin, sodium citrate and table salt were dissolved in water, this was gradually added to the corn oil while stirring with a *Homomixer* (made by Tokushu Kika Kogyo Co. Ltd.) and emulsified to obtain an oil-in-water and fat emulsion for use in cakes with an emulsified particulate diameter of 5-30μm.

Embodiment 2

An oil-in-water and fat emulsion for use in cakes was obtained by using 3g potassium citrate (anhydrate conversion) in place of the sodium citrate in Embodiment 1, with everything else the same as in Embodiment 1.

Embodiment 3

An oil-in-water and fat emulsion for use in cakes was obtained by using 3g sodium tartrate (anhydrate conversion) in place of the sodium citrate in Embodiment 1, with everything else the same as in Embodiment 1.

Embodiment 4

An oil-in-water and fat emulsion for use in cakes was obtained by using 3g sodium sulfate (anhydrate conversion) in place of the sodium citrate in Embodiment 1, with everything else the same as in Embodiment 1.

Embodiment 5

Corn oil	650g
Water	300g
β-cyclodextrin	30g
Polyglycerol ricinoleic acid ester (CR-310)	10g

In the above combination, the β-cyclodextrin was dissolved in water, this was gradually added to the corn oil in which the polyglycerol ricinoleic acid ester had been dissolved, while stirring with a *Homomixer*, and emulsified to obtain An oil-in-water and fat emulsion for use in cakes with an emulsified particulate diameter of 5-30μm.

Embodiment 6

An oil-in-water and fat emulsion for use in cakes was obtained by using 10g tetraglycerol stearate pentaester (SY-Glyster PS-310; made by Sakamoto Yakuhin Kogyo) instead of the polyglycerol ricinoleic acid ester in Embodiment 5, with everything else the same as in Embodiment 5.

Embodiment 7

Corn oil	650g
Water	354g
β-cyclodextrin	30g
Sodium citrate	3g
Table salt	3g
Polyglycerol ricinoleic acid ester	10g

Of the above combination, the β-cyclodextrin, sodium citrate and table salt were dissolved in water, this was gradually added to the corn oil in which the polyglycerol ricinoleic acid ester had been dissolved, while stirring with a *Homomixer*, and emulsified to obtain An oil-in-water and fat emulsion for use in cakes with an emulsified particulate diameter of 5-30μm.

Comparison Example 1

Corn oil	650g
Water	320g
β-cyclodextrin	30g

In the above combination, the β-cyclodextrin was dissolved in water and was gradually added to the corn oil, while stirring with a *Homomixer*, and emulsified to obtain an oil-in-water and fat emulsion for use in cakes with an emulsified particulate diameter of 5-30μm.

In order to evaluate the defoaming characteristic of the above-described emulsion, a whip test was conducted on the below combination. The results are shown in Table 1.

(Whip test)

Whole eggs	420g
Sugar	300g
Oil-in-water and fat emulsion	60g

Whole eggs, sugar and an oil-in-water and fat emulsion were placed into a five-quart bowl and mixed at medium speed (at 20° C) with a wire whisk. During this time, the specific gravity was measured at five minute intervals to determine the whip performance.

Table 1

	Whip performance (determined by specific gravity measurement)			
	After 5 min.	After 10 min.	After 15 min.	After 20 min.
Embodiment 1	0.405	0.263	0.245	0.243
2	0.412	0.268	0.250	0.247
3	0.410	0.270	0.251	0.250
4	0.408	0.269	0.253	0.248
5	0.411	0.270	0.258	0.251
6	0.405	0.258	0.252	0.250
7	0.411	0.265	0.255	0.251
Comparison Example 2*	0.605	0.408	0.305	0.290

*Safflower oil was used in place of the oil-in-water and fat emulsion of the present invention.

Next, a sponge cake was made from the below combination using the oil-in-water and fat emulsion obtained in the above embodiments and comparison examples, and the external appearance and texture were evaluated. The results are shown in Table 2.

[Making sponge cake]

Wheat flour (soft flour)	2kg
Sugar (very-refined sugar)	2kg
Whole eggs	2.8kg
Baking soda	30g
Foaming emulsified oil and fat	240g
Oil-in-water and fat emulsion	400g
Maltose	300g

Of the above combination, the whole eggs, sugar, maltose, foaming emulsified oil and fat and oil-in-water and fat emulsion were placed in a 30-quart bowl, and mixed for two minutes at slow speed using a wire whisk. After this, the wheat flour and baking soda were sifted and then added, mixing for 30 seconds at slow speed, then whipped at high speed to obtain a batter with a specific gravity of 0.45. This sponge cake batter was then baked in a 170° C oven for 35 minutes to obtain a sponge cake.

Table 2

	Cake specific volume (g/cc)	Cake internal condition	Cake softness *instantaneous elasticity (dyne/cm)	Cake melt-in-your-mouth aspect	Cake Flavor
Embodiment 1	4.5	Uniform Air Bubbles	3.9×10^4	Quite Good	Good
2	4.4	"	4.0×10^4	"	"
3	4.4	"	4.0×10^4	"	"
4	4.5	"	4.1×10^4	"	"
5	4.5	"	3.8×10^4	"	"
6	4.4	"	3.9×10^4	"	"
7	4.5	"	3.6×10^4	"	"
Comparison Example 1	4.5	Air Bubbles	5.3×10^4	Somewhat Chewy	"

*This indicates the instantaneous elasticity (dyne/cm) when cleavage was measured with a 2kg load cell and a 40g load using a cleave meter (using Yamaden Co. Ltd.'s *Leonar*).

[Operation/Efficacy]

As is clear from Table 1 and Table 2, the oil-in-water and fat emulsion for cakes that is the oil-in-water emulsified product of the present invention does not exhibit defoaming of oils and fats, and hence can provide an improved cake which has a large specific volume, is soft, has a rough texture and good melt-in-your-mouth characteristics.

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[Seal]

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